Pipe Flows – Introduction
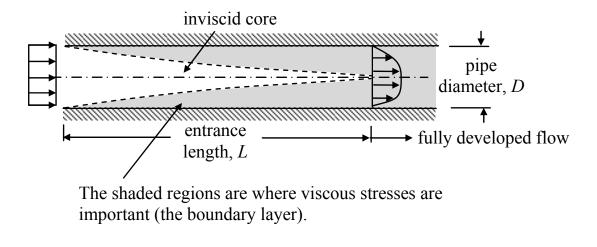

(Image from: https://www.theprocesspiping.com/introduction-to-piping-system/)

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The shaded regions are where viscous stresses are important (the boundary layer).

laminar flow: $L/D \approx 0.06 \, \mathrm{Re}_D$
turbulent flow: $L/D \approx 4.4 \, \mathrm{Re}_D^{1/6}$
For many engineering flows:
$\quad 10^4 < \mathrm{Re}_D < 10^5 \;\Rightarrow\; 20 < L/D < 30$

Interesting trivia: Pumping costs are typically between 16%[1] and 40%[2] of an industrial facility's energy usage.

(1) https://www.energy.gov/sites/prod/files/2014/05/f16/reduce_pumping_costs.pdf
(2) http://pumps.org/EnergyEfficiency.aspx